

What Is Claimed Is:

Sub A2 }
1. A manual input device comprising:
a knob;
feeling providing means which have at least two
kinds of feeling patterns; and
an actuator which activates the feeling providing
means and changes an operation feeling given to the knob.

Sub B1 }
2. The manual input device according to Claim 1,
wherein the knob is manipulated by linear movement.

3. The manual input device according to Claim 1,
wherein the knob is manipulated by rotation.

4. The manual input device according to Claim 1,
wherein the knob is manipulated by rotation in at least
two directions.

Sub A3 }
5. The manual input device according to Claim 1,
wherein the feeling providing means comprises a
disc or cylinder which bears plural feeling patterns
(rows) and is fixed to a control shaft to be manipulated
by the knob; and a ball or pin elastically forced to contact
the disc or cylinder, and

cont
wherein the actuator linearly reciprocates the ball
or pin in a direction where the plural feeling patterns

are arranged.

6. The manual input device according to Claim 1, wherein the feeling providing means comprises a disc or cylinder which has a single feeling pattern (row) and is fixed to a control shaft to be manipulated by the knob; and plural balls or pins elastically forced to contact the disc or cylinder, and

wherein the actuator linearly reciprocates one of the plural balls or pins in a direction where it selectively engages with the feeling pattern.

7. The manual input device according to Claim 1, wherein the feeling providing means comprises a rotary polyhedron which bears plural feeling patterns (rows) arranged in parallel along an axial direction of its outer surface, and

wherein the actuator reciprocally rotates the rotary polyhedron around its axis, with one end of a control shaft to be manipulated by the knob being in contact with the outer surface of the rotary polyhedron bearing the feeling patterns.

8. A manual input device comprising:

a knob;

feeling providing means which provides the knob with an operation feeling;

an actuator which activates the feeling providing means;

detecting means which detects an operating condition of the knob; and

an input/output section which exchanges signals with an external device controlled by the knob,

wherein the actuator is controlled according to a control signal generated based on an external signal from external detecting means connected at least with the external device.

9. The manual input device according to Claim 8, wherein the knob is manipulated by linear movement.

10. The manual input device according to Claim 8, wherein the knob is manipulated by rotation.

11. The manual input device according to Claim 8, wherein the knob is manipulated by rotation in at least two directions.

12. The manual input device according to Claim 8, wherein the feeling providing means comprises a disc or cylinder which bears plural feeling patterns (rows) and is fixed to a control shaft to be manipulated by the knob; and a ball or pin elastically forced to contact the disc or cylinder, and

wherein the actuator linearly reciprocates the ball or pin in a direction where the plural feeling patterns are arranged.

13. The manual input device according to Claim 8, wherein the feeling providing means comprises a disc or cylinder which bears a single feeling pattern (row) and is fixed to a control shaft to be manipulated by the knob; and plural balls or pins elastically forced to contact the disc or cylinder, and

wherein the actuator linearly reciprocates one of the plural balls or pins in a direction where it selectively engages with the feeling pattern.

14. The manual input device according to Claim 8, wherein the feeling providing means comprises a rotary polyhedron which bears plural feeling patterns (rows) arranged in parallel along an axial direction of its outer surface, and

wherein the actuator reciprocally rotates the rotary polyhedron around its axis, with one end of a control shaft to be manipulated by the knob being in contact with the outer surface of the rotary polyhedron bearing the feeling patterns.

15. A manual input device comprising:
a knob;

feeling providing means which provides the knob with an operation feeling;

an actuator which activates the feeling providing means;

a control section for the actuator;

detecting means which detects an operating condition of the knob; and

an input/output section which exchanges signals with an external device controlled by the knob,

wherein an external signal from external detecting means connected at least with the external device is inputted into the control section through the input/output section to generate a control signal for the actuator to match at least the external signal, and wherein the actuator is controlled according to the control signal.

16. A manual input device comprising:

a knob;

feeling providing means which provides the knob with an operation feeling;

an actuator which activates the feeling providing means;

a control section for the actuator;

detecting means which detects an operating condition of the knob; and

an input/output section which exchanges signals

with an external device controlled by the knob,

wherein both a detection signal at least from the detecting means and an external signal from external detection means connected with the external device are inputted into the external device to generate control information for the actuator to match the detection signal and the external signal, wherein the control information is picked up by the control section through the input/output section to generate a control signal for the actuator to match the control information, and wherein the actuator is controlled according to the control signal.

17. A manual input device comprising:

a knob;

feeling providing means which provides the knob with an operation feeling;

an actuator which activates the feeling providing means;

detecting means which detects an operating condition of the knob; and

an input/output section which exchanges signals with an external device controlled by the knob,

wherein both a detection signal at least from the detecting means and an external signal from external detection means connected with the external device are inputted into the external device to generate a control

signal for the actuator to match the detection signal and the external signal, and wherein the actuator is controlled according to the control signal.

18. A car-mounted apparatus controller comprising:
a function selection switch for selecting one function among various functions to be controlled; and
a manual input device for controlling the function selected by the function selection switch,
the manual input device comprising:
a knob;
feeling providing means having at least two kinds of feeling patterns; and
an actuator for activating the feeling providing means and changing an operation feeling given to the knob.

19. A car-mounted apparatus controller comprising:
an electric apparatus selection switch for selecting an electric apparatus to be controlled;
a function selection switch for selecting one of various functions of the electric apparatus selected by the apparatus selection switch; and
a manual input device for controlling a function selected by the function selection switch,
the manual input device comprising:
a knob;
feeling providing means for providing the knob with

an operation feeling;

an actuator for activating the feeling providing means;

detecting means for detecting an operating condition of the knob; and

an input/output section which exchanges signals with an external device controlled by the knob,

wherein the actuator is controlled according to a control signal generated based on both a detection signal at least from the detecting means and an external signal from external detecting means connected with the external device.

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Figure 1 consists of 12 histograms arranged in two rows of six. The top row is labeled '1000' and the bottom row is labeled '100'. Each histogram shows the frequency of the number of non-zero elements in the vector of the first 1000 iterations of the algorithm. The x-axis for all histograms is 'Number of non-zero elements' ranging from 0 to 100. The y-axis is 'Frequency' ranging from 0 to 100. The distributions are roughly bell-shaped and centered around 50-60 non-zero elements.